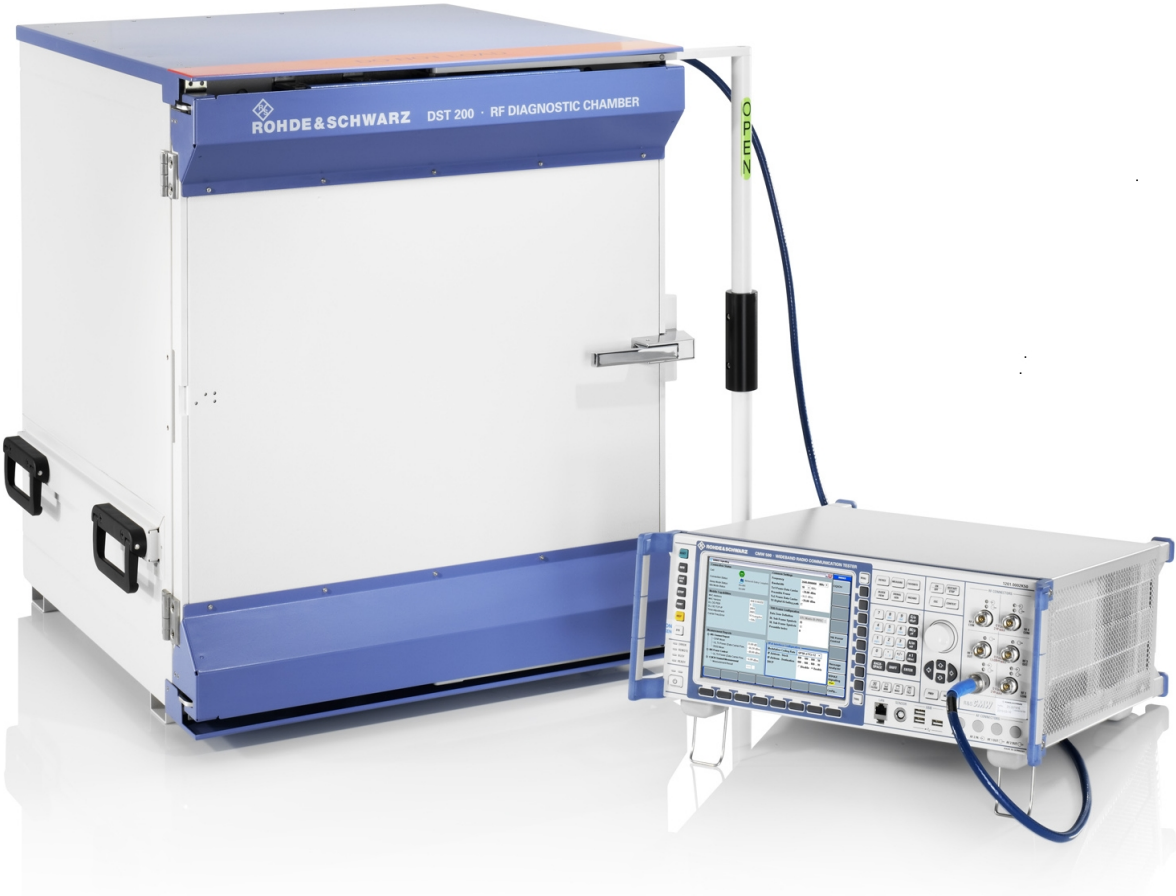


R&S® DST200

RF Diagnostic Chamber

User Manual



1515.1421.02 – 01

This manual describes the RF Diagnostic Chamber R&S®DST200, order no. 1510.9047.02, including all options and accessories:

- "DT200 Filter Panel, LP & FO", R&S DST-B101, stock number 1514.7778.02
- "DT200 Interface Panel, RF", R&S DST-B102, no. 1514.7784.02
- "DT200 Filter Panel, USB", R&S DST-B103, no. 1514.7990.02
- "3D Positioner", R&S DST-B150, no. 1515.1480.02
- "Elevated EUT Table", R&S DST-B130, no. 1515.1467.02
- "RF Cable 18 GHz, 1.5 m", R&S DST-Z18, no. 1515.1473.02

The front door of the RF Diagnostic Chamber is available with either left-hand mounting (selection R&S DST-S100A, order no. 1515.1396.02) or right-hand mounting (selection R&S DST-S100B, order no. 1515.1396.03).

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The following abbreviations are used throughout this guide: R&S®DST200 is abbreviated as R&S DST200, options R&S®DST-Bxxx as R&S DST-Bxxx. The instruments R&S®CMWxxx and R&S®CMU200 are abbreviated as R&S CMWxxx and R&S CMU200; R&S®TS8991 and R&S®AMS32 as R&S TS8991 and R&S AMS32, respectively.

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Basic Safety Instructions

Always read through and comply with the following safety instructions!









All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.







Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Symbols and safety labels

							
Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Be careful when handling electrostatic sensitive devices

					
ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.



indicates a hazardous situation which, if not avoided, will result in death or serious injury.



indicates a hazardous situation which, if not avoided, could result in death or serious injury.



indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



indicates the possibility of incorrect operation which can result in damage to the product.

In the product documentation, the word ATTENTION is used synonymously.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of $\pm 10\%$ shall apply to the nominal voltage and $\pm 5\%$ to the nominal frequency.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

If the information on electrical safety is not observed either at all to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.
3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

Basic Safety Instructions

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad adjunto de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.







Informaciones elementales de seguridad

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Símbolos y definiciones de seguridad

							
Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Advertencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)

					
Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.



PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.



ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.



ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

Informaciones elementales de seguridad

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.
2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Kundeninformation zur Batterieverordnung (BattV)

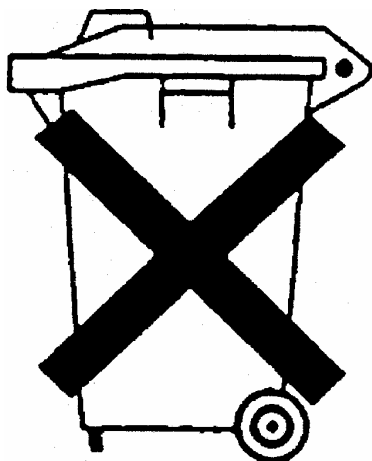
Dieses Gerät enthält eine schadstoffhaltige Batterie. Diese darf nicht mit dem Hausmüll entsorgt werden.

Nach Ende der Lebensdauer darf die Entsorgung nur über eine Rohde&Schwarz-Kundendienststelle oder eine geeignete Sammelstelle erfolgen.

Safety Regulations for Batteries (according to BattV)

This equipment houses a battery containing harmful substances that must not be disposed of as normal household waste.

After its useful life, the battery may only be disposed of at a Rohde & Schwarz service center or at a suitable depot.



Normas de Seguridad para Baterías (Según BattV)

Este equipo lleva una batería que contiene sustancias perjudiciales, que no se debe desechar en los contenedores de basura domésticos.

Después de la vida útil, la batería sólo se podrá eliminar en un centro de servicio de Rohde & Schwarz o en un depósito apropiado.

Consignes de sécurité pour batteries (selon BattV)

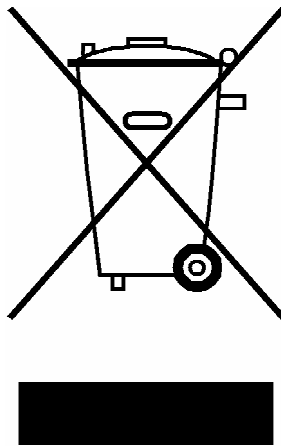
Cet appareil est équipé d'une pile comprenant des substances nocives. Ne jamais la jeter dans une poubelle pour ordures ménagères.

Une pile usagée doit uniquement être éliminée par un centre de service client de Rohde & Schwarz ou peut être collectée pour être traitée spécialement comme déchets dangereux.

Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).



Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.



Qualitätszertifikat

Certificate of quality

Certificat de qualité

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO9001 und ISO14001 zertifiziert.

Der Umwelt verpflichtet

- ▮ Energie-effiziente, RoHS-konforme Produkte
- ▮ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ▮ ISO 14001-zertifiziertes Umweltmanagementsystem

Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO9001 and ISO14001.

Environmental commitment

- ▮ Energy-efficient products
- ▮ Continuous improvement in environmental sustainability
- ▮ ISO 14001-certified environmental management system

Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO9001 et ISO14001.

Engagement écologique

- ▮ Produits à efficience énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

Europe, Africa, Middle East

Phone +49 89 4129 12345
customersupport@rohde-schwarz.com

North America

Phone 1-888-TEST-RSA (1-888-837-8772)
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1 Safety Instructions

This R&S DST200 RF Diagnostic Chamber has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

CAUTION

General safety instructions

To maintain this condition and to ensure safe operation, you must observe all instructions and warnings given in this manual. Please notice in particular the instructions below on this page.

1. In order to comply with local EMC regulations, it may be necessary in some places to have the front door closed when using the RF Diagnostic Chamber. It is the user's responsibility to ensure that the chamber is used in compliance with local regulations.
2. The RF Diagnostic Chamber must be stabilized, either by means of four screws through the feet or by the balancing weight in the slot at the back. Otherwise it may tilt forward when the front door is opened.
3. In view of its weight, at least two persons are required to carry the RF Diagnostic Chamber. The front door must be closed and the locking handle must be fastened in CLOSED position whenever the RF Diagnostic Chamber is carried or shipped. Use a cable tie or Velcro® strip to fix the locking handle to the carrying handle on the left side of the chamber.
4. The metallic EMI/EMC shielding gaskets around the joint of the front door are expendable parts that must be regularly cleaned and need to be exchanged if they are visibly corroded or damaged; see [chapter 6, "Maintenance"](#), on page 34.
5. When mounting a connector module (one of the feed throughs R&S DST-B101, DST-B102, R&S DST-B103), ensure that the contact surfaces are clean and the EMI/EMC shielding gaskets are in correct position.
6. When leaving the RF Diagnostic Chamber in a storage room that can be accessed by small children or when disposing of the chamber, always remove the locking handle to ensure that the chamber can be opened from inside.

Please also read [chapter 2, "Short Description"](#), on page 6 and [chapter 7, "Installation, Repair, Functional Check"](#), on page 35 for more detailed information about safety-related issues.

2 Short Description

The RF Diagnostic Chamber R&S DST200 is a fully enclosed, RF-shielded anechoic chamber for interference-free and reflection-free tests of mobile phones (MS) and other devices with radio interfaces. R&S DST200 is particularly suited for over-the-air (OTA) performance tests and receiver sensitivity degradation (desense) tests in line with the CTIA, CWG and PTCRB standards. Automated measurements may be performed in combination with the R&S®TS8991 OTA Performance Test System and the R&S® AMS32 OTA software.

The chamber is also appropriate for general receiver and transmitter tests using a radio communication tester, e.g. a wideband radio communication tester of the R&S CMW family or a Universal Radio Communication Tester R&S CMU200.

The RF Diagnostic Chamber is delivered with an integrated broadband test antenna (TA) which ensures the transmission of RF signals between the equipment under test (EUT) and the test instruments. The antenna design is optimized to create a circularly polarized electromagnetic field with a highly uniform spatial distribution within the test space of the diagnostic chamber. In this way the variation of the EUT coupling to the test antenna as a function of the location and orientation of the EUT is minimized.

The EUT is placed on a table inside the chamber. Due to the absorbing walls of the chamber and the distance between the TA and the EUT table, measurements can be performed under free-space conditions. On its right wall, below the top cover, the chamber provides a single N connector RF ANT for the RF connection to the test instruments.

The following options and accessories may be ordered in addition:

- The "DST200 Filter Panel, LP&FO" (R&S DST-B101) provides an additional 9-pin D-Sub connector with integrated low-pass filter and a 2x FSMA fibre optic interface for the DC supply and the AF or data signals of the EUT.
- The "DST200 Interface Panel, RF" (R&S DST-B102) provides two additional RF connectors for tests with several RF signals.
- The "DST200 Filter Panel, USB" (R&S DST-B103) with integrated low-pass filter is used for additional USB 2.0 data connections.
- The "3D Positioner" (R&S DST-B150) holds the EUT at a specific angular orientation; see [chapter 2.4, "3D Positioner"](#), on page 11.
- The "Elevated EUT Table" (R&S DST-B130) is used to place the EUT close to the test antenna; see [chapter 2.5, "Elevated EUT Table"](#), on page 12.
- The "RF Cable 18 GHz, 1.5 m" (accessory R&S DST-Z18) is an RF cable with a high shielding effectiveness; see ["RF connection"](#) on page 10.

The connectors are mounted at the positions shown in figure [RF Diagnostic Chamber with accessories](#) or at the free connector port on top of the right-hand wall; see [chapter 7.3, "Mounting Filter and Interface Panels"](#), on page 36.

The present manual describes the positioning and use of the chamber, the measurement of path loss factors, the installation of the additional filter panel options, and the functional check. The technical specifications of the RF Diagnostic Chamber are listed in the data sheet PD 5214.3600.22.

Positioning the RF Diagnostic Chamber

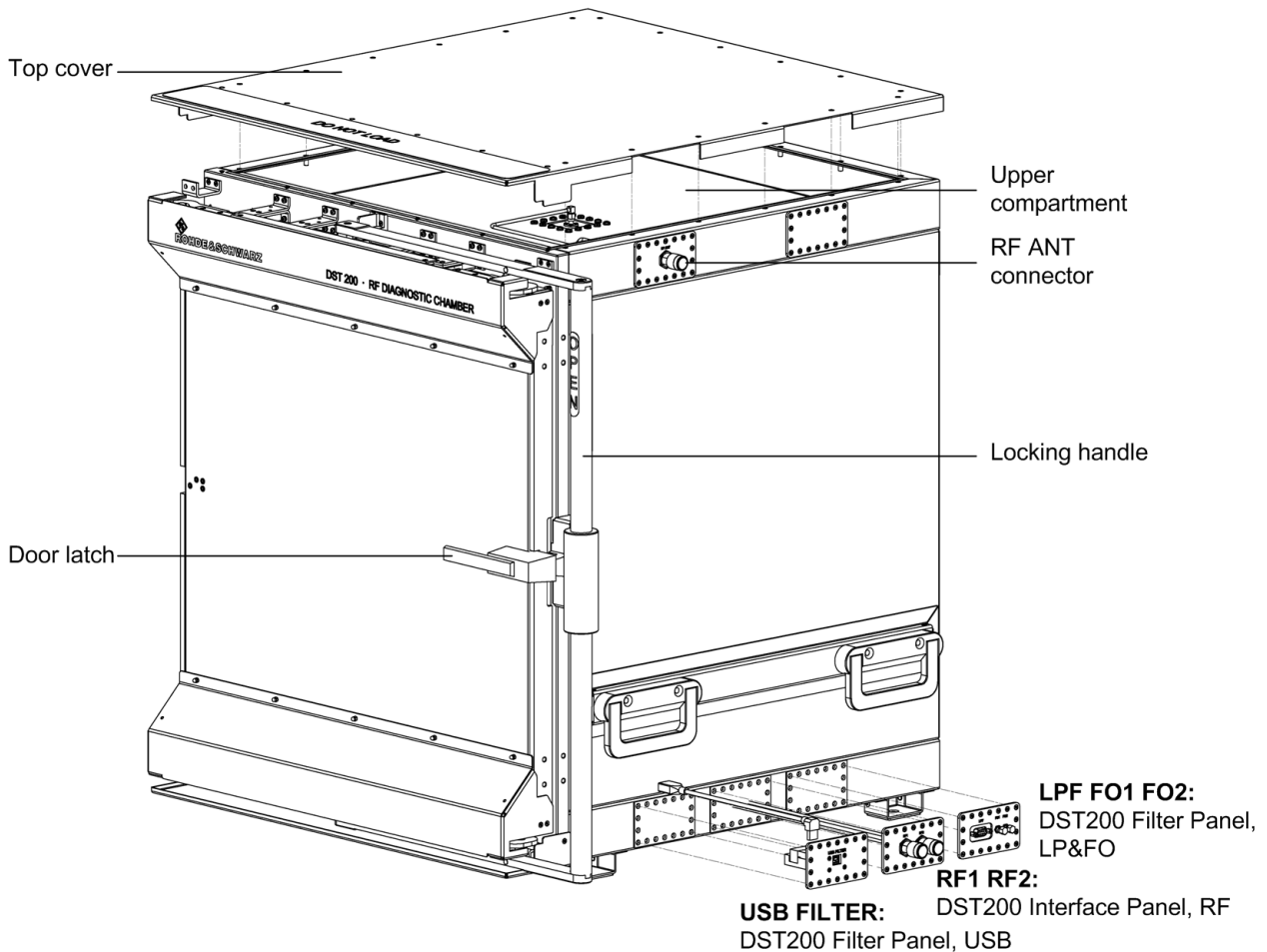


Fig. 2-1: RF Diagnostic Chamber with accessories

2.1 Positioning the RF Diagnostic Chamber

The RF Diagnostic Chamber is intended for operation on a flat, stable surface. Apply one of the following methods to ensure a stable position:

- Screw the four feet of the chamber to the surface.
- Ensure that the balancing weight is in the slot at the back of the chamber and affixed by the two screws on either side; see [figure 2-2](#).

CAUTION

Risk of injury

If the RF Diagnostic Chamber is not properly stabilized as described above, it may tilt forward when the front door is opened.

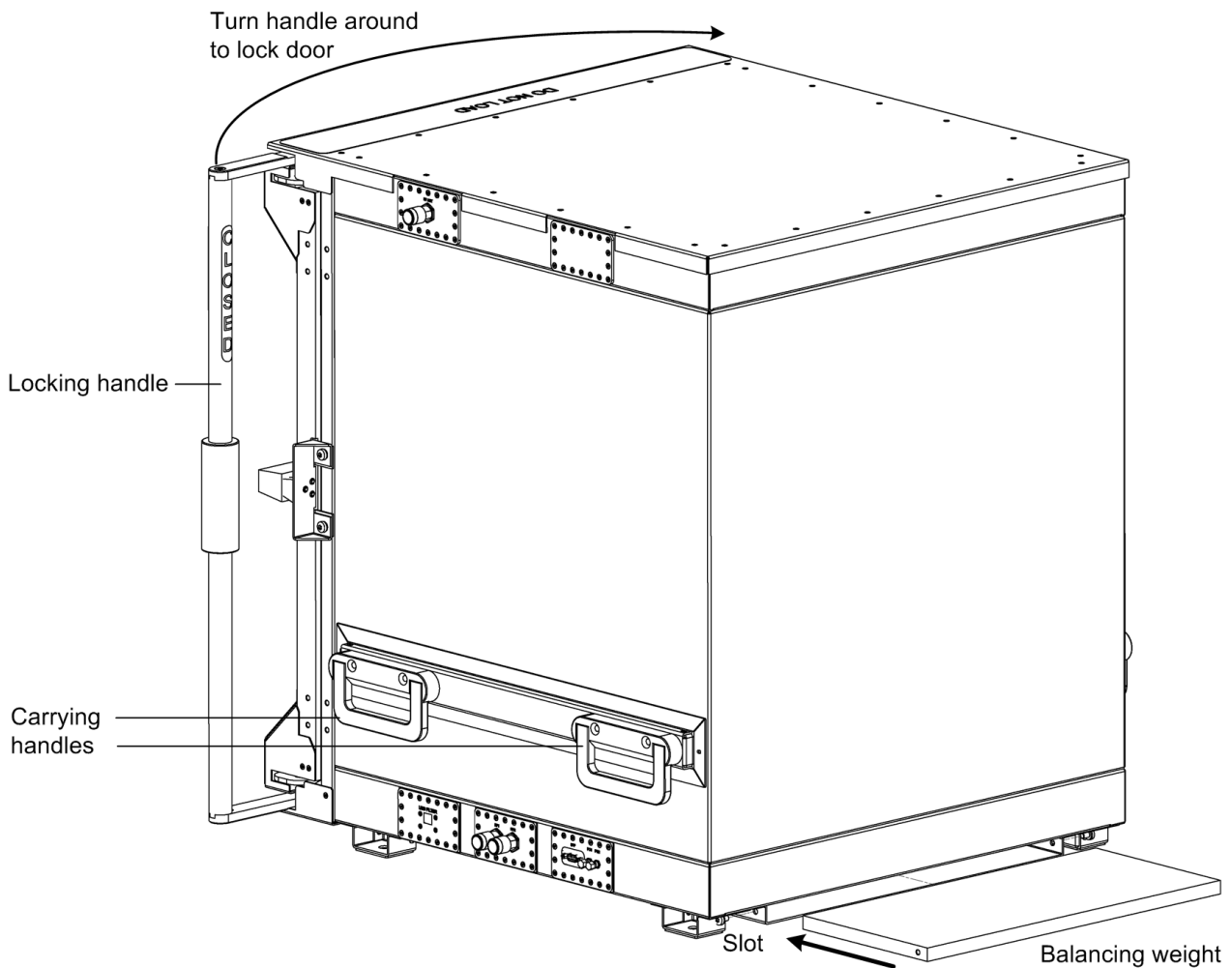


Fig. 2-2: Position of balancing weight

In view of its weight (see data sheet), at least two persons are required to carry the RF Diagnostic Chamber using the four handles on both side walls. If you wish to remove the balancing weight for easier transport, open the two screws on either side and remove it from the slot.

2.2 Opening and Closing the Front Door

The RF Diagnostic Chamber is accessible by the front door. A U-shaped joint around the front side of the chamber accommodates metallic EMI/EMC shielding gaskets which ensure a good, continuous electrical contact. The 2-stage opening and closing mechanism of the door ensures a planar movement into the U-shaped joint. This protects the shielding gaskets from mechanical damage and increases their lifetime. It also provides a self-cleaning effect so that the shielding effectiveness is maintained even after a long time of use.

The RF Diagnostic Chamber is available with either left-hand front door mounting (selection R&S DST-S100A, order no. 1515.1396.02) or right-hand mounting (selection R&S

DST-S100B, order no. 1515.1396.03). The two selections are symmetric to each other; [figure 2-2](#) shows a door with a left-hand mounting (hinges on the left side).

To open the front door,

1. Make sure that the RF Diagnostic Chamber is properly stabilized as described in [chapter 2.1, "Positioning the RF Diagnostic Chamber"](#), on page 7.
2. Turn the locking handle to the OPEN position as shown in [figure 2-1](#).
3. Pull the door latch in forward direction to release the closing mechanism.

To close the door,

1. Push the wing of the door against the front side of the chamber **until the latch is closed**.
2. Push the locking handle towards the CLOSED direction.

⚠ CAUTION**Risk of damage or injury**

For safety reasons, the door also opens while the door latch is closed and the handle is in the OPEN position. It remains locked as long as the handle is CLOSED. Notice the general [Safety Instructions](#) when shipping the chamber or when disposing of the chamber.

2.3 Connecting the EUT and the Test Equipment

The purpose of the EUT table inside the RF Diagnostic Chamber is to hold EUTs in the zone far away from the test antenna, where the RF field is circularly polarized and approximately homogeneous. Due to these field characteristics, the exact position of the EUT on the table is generally not critical. To perform measurements at a specific EUT orientation, use the 3D positioner described in [chapter 2.4, "3D Positioner"](#), on page 11.

Connection to the test equipment

The outer N connector "RF ANT" on the right wall of the RF Diagnostic Chamber is connected to the bidirectional RF connectors of the test equipment (e.g. R&S CMW500, RF1 COM connector). No additional cable is needed, since the antenna will ensure the internal RF connection to the EUT.

NOTICE**RF connection**

The RF transmissions and the path loss depend on the RF connection between the "RF ANT" connector and the RF input/output of the test instrument. To limit RF emissions, it is recommended to use the high-quality RF cable supplied with the RF Diagnostic Chamber.

For best results, especially at frequencies above 3 GHz, an optimized cable (accessory R&S DST-Z18, stock number 1515.1473.02) can be ordered from Rohde & Schwarz.

The following connections may be used in addition:

- The "DST200 Filter Panel, LP&FO" provides a 9-pin D-Sub connector and a 2x FSMA fiber optic interface for the DC supply and the AF or data signals of the EUT. An integrated low-pass filter ensures high shielding effectiveness of the D-Sub connector. The FSMA connectors are particularly suited for connections with high data rates; a typical example is a LAN connection to the EUT. A LAN to fibre optic converter is placed outside the RF Diagnostic Chamber, a second converter for the connection of the EUT may be placed inside the lower compartment.
- The "DST200 Interface Panel, RF" provides two additional type N feed through connectors. Together with the "RF ANT" connector, the RF interface panel allows you to supply the EUT with up to three independent RF signals. An additional RF feed through is also suited for connecting a reference antenna; see [chapter 5, "Reference Path Loss Measurement"](#), on page 28.
- The "DST200 Filter Panel, USB" can be used for USB data connections to the EUT. An integrated low-pass filter ensures high shielding effectiveness of the USB connector. Use shielded USB cables according to standard USB 2.0 to establish the connection to the EUT and an external controller.

The additional connector modules can be mounted or removed as described in [chapter 7.3, "Mounting Filter and Interface Panels"](#), on page 36. To establish the internal connections to the EUT, you have to access the upper and/or lower compartments of the chamber as described in [chapter 7, "Installation, Repair, Functional Check"](#), on page 35.

NOTICE**Connecting USB cables and shielding requirements**

The "USB 2.0 Feed Through" causes no radiation that might impair the shielding effect of the chamber. To avoid interference from the external connecting line, use a shielded USB cable that is equipped with EMI ferrite attenuators.

2.4 3D Positioner

The 3D Positioner for R&S DST200 (option R&S DST-B150) holds the EUT at a specific angular orientation. Measurements at well-defined orientations are often required in the product design process. The Cellular Telecommunications & Internet Association (CTIA) specifies appropriate spherical coordinates for the EUT orientation; refer to the "CTIA Certification, Test Plan for Mobile Station Over the Air Performance, Method of Measurement for Radiated RF Power and Receiver Performance, Rev. 3.0".

The 3D Positioner replaces the EUT table in the R&S DST200. The EUT is fixed along the central axis of the EUT holder as shown below.



Fig. 2-3: R&S DST200 with 3D Positioner

The center of the positioner is 70 mm above the center of the EUT table. The EUT orientation can be modified and fixed as follows:

- Turning the outer cylinder varies the polar angle θ : The θ axis rotator is oriented along the central axis of the outer cylinder.
- Turning the EUT holder inside the outer cylinder varies the azimuth angle φ : The φ axis rotator is oriented along the central axis of the EUT holder.

The θ angle can be read from the scale on the outer cylinder, at the " θ – REF X" line marked on the positioner support. The φ angle is indicated on the EUT holder and can be read at the " φ – REF" line marked on the outer cylinder. The following figure shows the EUT holder together with the fixed rectangular coordinate system of the chamber (green lines). The z-axis of the coordinate system points towards the test antenna, the x-axis points to the right of the chamber, the y-axis to the back.

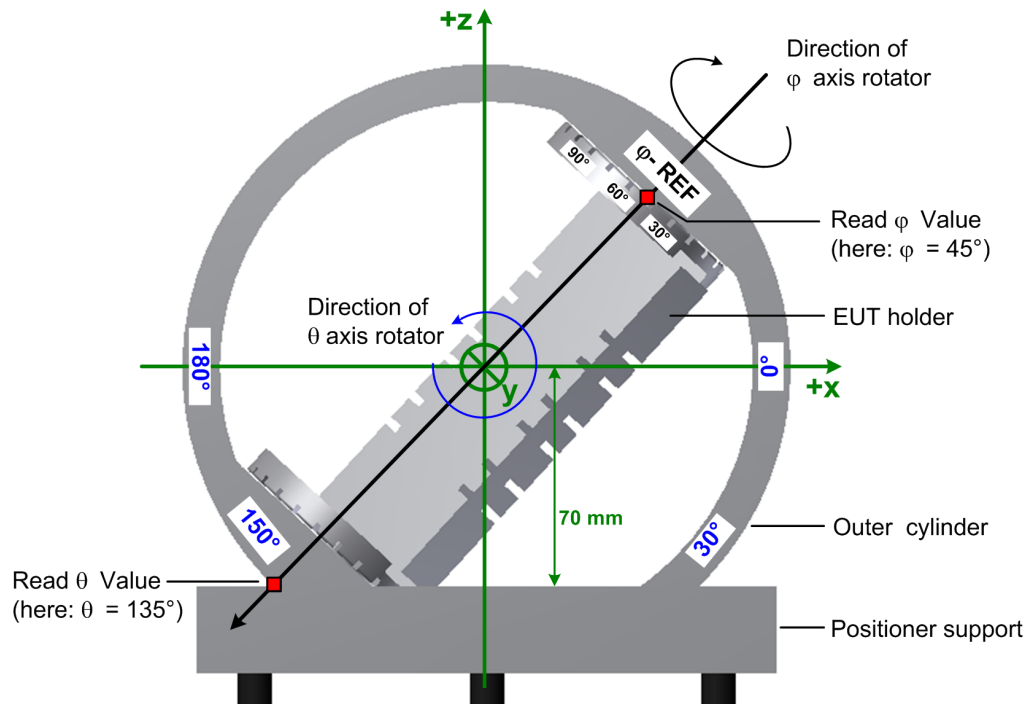


Fig. 2-4: Rectangular and spherical coordinates for the 3D positioner

If the positioner is turned such that both angles are zero ($\theta = \varphi = 0^\circ$), then the EUT is oriented vertically (along the z-axis), and its face points in +x-direction.

In the standard position shown in [figure 2-3](#), where you can look through the outer cylinder, the readings for θ and φ are in accordance with the coordinate definitions of the CTIA certification.

It is also possible to turn the outer cylinder by 90° . In this case the signal at the test antenna output RF ANT relates to the orthogonal polarization of the EUT and the θ position should be read at the " $\theta - \text{REF Y}$ " line marked on the positioner support.



Circular polarization of the test antenna

Since the test antenna has nominally a circular polarization, it verifies two linear polarization characteristics of the EUT simultaneously. In an EUT radiation measurement, the output power P_{TA} at the RF ANT connector depends on both orthogonal components in the x-y plane of the EUT's radiated field (E_x and E_y) incident on the test antenna. In the case where the EUT is illuminated by the test antenna, the input power P_{TA} at the RF ANT connector creates two orthogonal field components in the x-y plane incident on the EUT.

2.5 Elevated EUT Table

The Elevated EUT Table (option R&S DST-B130) is used to place the EUT to a position close to the test antenna below the cover of the RF Diagnostic Chamber. This reduces

the path loss between the test antenna and EUT, at the expense of field uniformity. For examples of the electric field strength radiated by the test antenna within the chamber refer to the R&S DST200 product brochure, no. PD 5214.3600.12.

The EUT table is mounted **on top** of the lower EUT table (supplied with every chamber) as shown below.

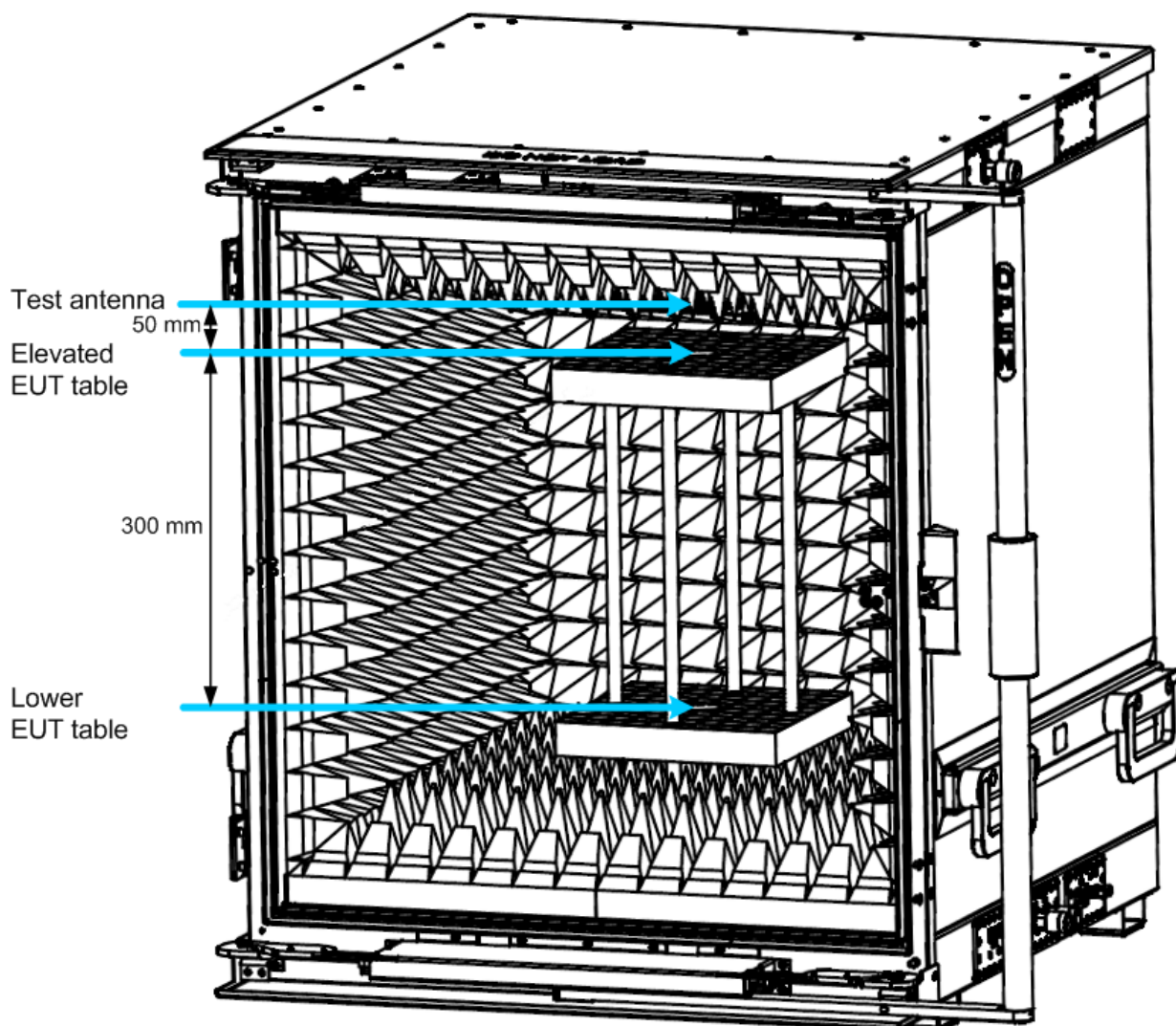


Fig. 2-5: Mounting the elevated EUT table

The center point of the elevated EUT table is 300 mm above the center of the lower table. Its distance from the test antenna is 50 mm.

3 Test Scenarios

The basic test setup for receiver and transmitter tests in an interference-free and reflection-free environment is shown below. The equipment under test (typically, a mobile station, but also any other device with a radio interface) is placed on the EUT table inside the RF Diagnostic Chamber. The bidirectional RF connector RF ANT is connected to a radio communication tester. The tester serves as a base station simulator (BSS) providing a downlink/forward link signal for receiver tests and measuring the uplink signal from the EUT.

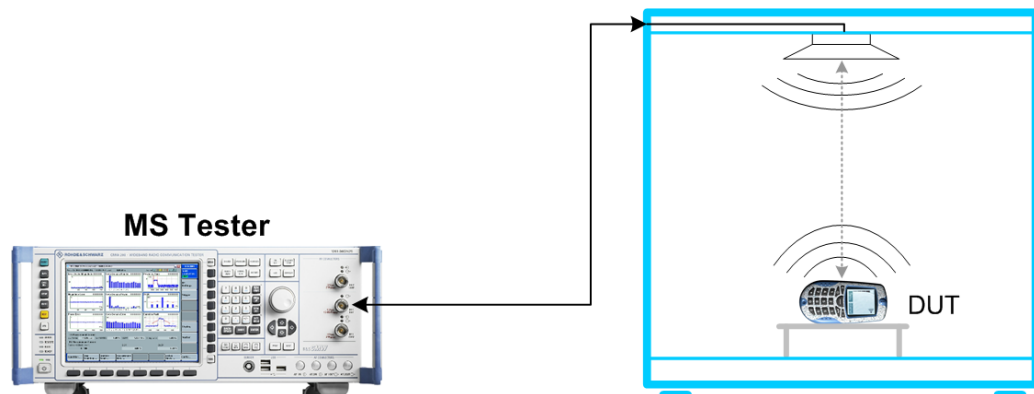


Fig. 3-1: Basic test setup for receiver and transmitter tests

Knowledge of the RF path loss in downlink and uplink direction is essential for this type of measurement; see [chapter 4, "Path Loss Measurement"](#), on page 16.

3.1 Desense and Self-Interference Tests

Desense is the degradation of receiver performance, which is typically caused by in-band or out-of-band signals or broadband noise. The receiver performance is characterized by the sensitivity level, i.e. the minimum RF input signal level where the Bit Error Rate is below a given threshold value. Receiver desense results in an increased sensitivity level. The following figure shows a desense test in the GSM900 band. The two sharp peaks are caused by self-interference on two particular channels.

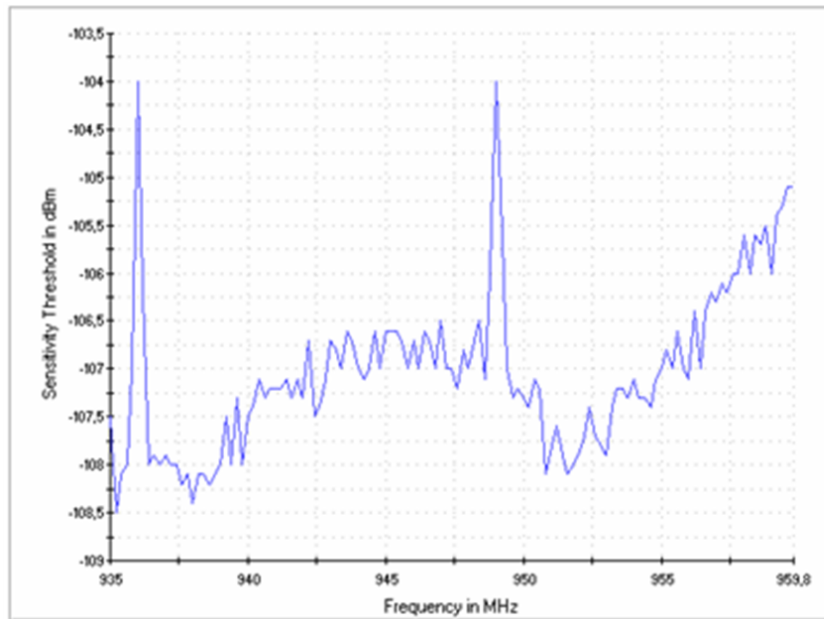


Fig. 3-2: GSM desense test

Coexistence tests

The following figure shows a test setup for a Bluetooth® / GSM coexistence test with the RF Diagnostic Chamber and two radio communication testers. The R&S CBT Bluetooth® tester maintains a connection to the EUT and measures the sensitivity level. An R&S CMW500 is used to set up a parallel GSM connection which may (or may not) adversely affect the Bluetooth® sensitivity level.

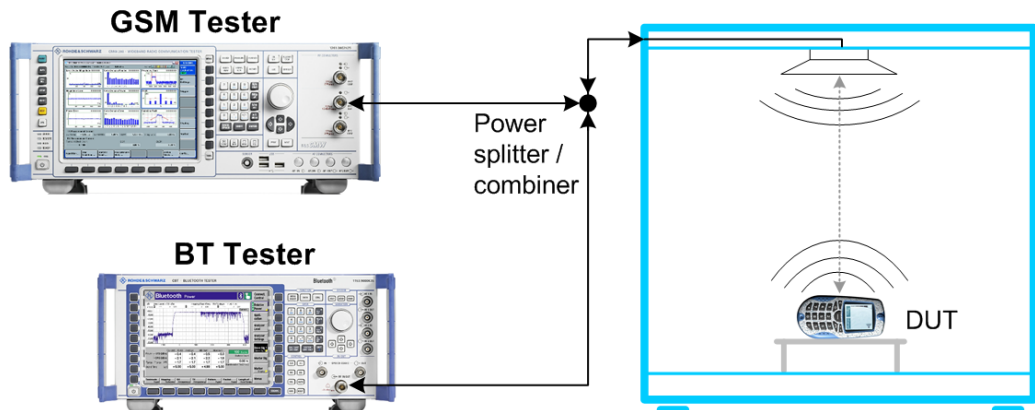


Fig. 3-3: Test setup for Bluetooth / GSM coexistence tests

4 Path Loss Measurement

RF signals are attenuated on their way from the equipment under test (EUT) to the test instrument and back. The total path loss in either direction includes the contribution of the range path loss PL_r due to the distance r between the EUT and the test antenna of the RF Diagnostic Chamber (including its connection to the RF ANT connector), the loss PL_A introduced by the antenna, and any loss PL_{ex} in the signal path between RF ANT and the input/output connector of the test instrument. All these contributions may depend on the signal direction.

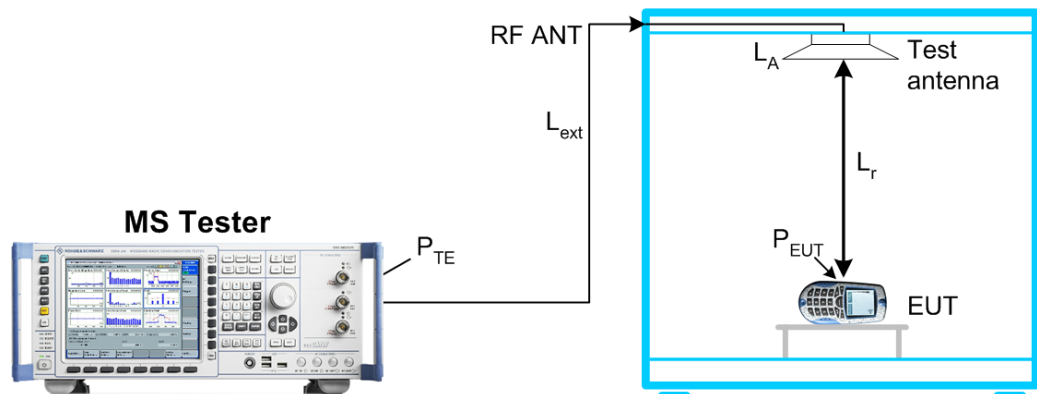


Fig. 4-1: Path loss

We define the total path loss for the two signal directions as the difference between transmitted and received powers:

- $Input\ path\ loss/dB = P_{EUT, out} - P_{TE, in}$
 $= \langle EUT\ output\ power \rangle / dBm - \langle RF\ input\ power\ at\ tester \rangle / dBm$
- $Output\ path\ loss/dB = P_{TE, out} - P_{EUT, in}$
 $= \langle Generator\ level\ of\ tester \rangle / dBm - \langle Received\ signal\ level\ at\ the\ EUT \rangle / dBm$

Once the path loss values are known for a given EUT type, position, and RF connection they can be reported to the test instrument as external attenuation factors ("External Attenuation (Input)", "External Attenuation (Output)"). The tester will then correct all power measurements by the reported input path loss and increase its RF generator level to compensate for the output path loss.

In the definitions above the sign of the input and output path loss is in accordance with the definition of external input and output attenuation factors ("Ext. Att. Input", "Ext. Att. Output") in the R&S CMW and R&S CMU200.



Path loss and EUT type, EUT position

The path loss values depend on the EUT type. Results for a particular EUT (e.g. a mobile phone) type should be determined using a fully functional and proven device ("golden" device); they may then be applied to all EUTs of the same type.

If the EUT is placed on the table inside the RF Diagnostic Chamber, the RF field of the test antenna is circularly polarized and sufficiently homogeneous so that measurement results do not much depend on the exact position and orientation of the EUT antenna. Consequently, the path loss measurement procedure described in this chapter is sufficient for basic receiver and transmitter tests.

For over-the-air (OTA) performance tests, a more elaborate "reference path loss" measurement is required to remove the test system's influence from radiated power and sensitivity results; see [chapter 5, "Reference Path Loss Measurement"](#), on page 28.

4.1 Input Path Loss

If an external input attenuation is reported to the test instrument, all EUT power readings are increased. The tester shows the actual EUT transmitter output power which is higher than the level at its input connectors.

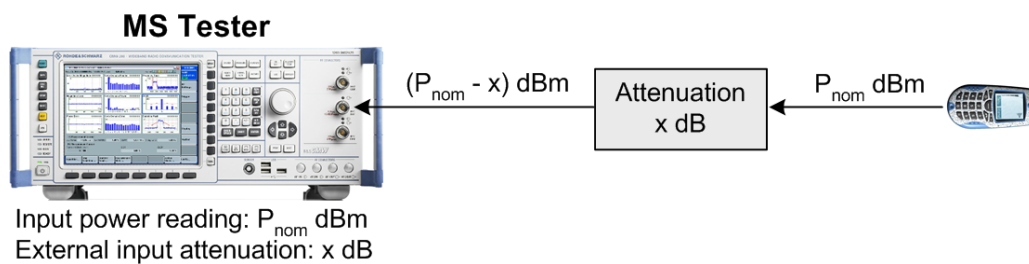


Fig. 4-2: Definition of input path loss

4.2 Output Path Loss

If an external output attenuation is reported to the test instrument, the generator power is increased relative to the nominal generator power setting. The actual signal power at the input of the EUT, after attenuation by the test setup, is equal to the nominal generator power.

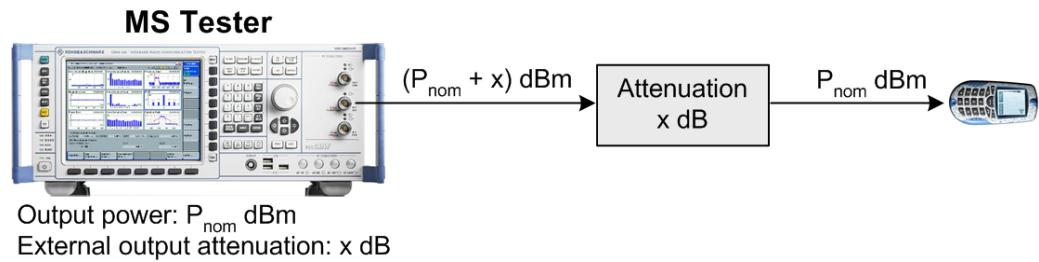


Fig. 4-3: Definition of output path loss

4.3 Determining Path Loss Values: R&S CMW

External input and output attenuation factors are reported in the configuration dialogs of the different measurement and generator/signaling firmware applications of the R&S CMW. The procedure for determining the path loss values is analogous for all networks; for an overview refer to [chapter 4.3.4, "Other Network Standards"](#), on page 20. The following example shows the necessary steps for a WiMAX mobile phone.



The following example requires an R&S CMW tester (model R&S CMW500 or R&S CMW270) equipped with the "WiMAX Measurements" and the "WiMAX Signaling" firmware applications. If no signaling application is available for a given network standard, you have to determine the received signal power and the transmitter output power of your EUT by external means.

4.3.1 Preparatives

In the following example, the EUT is a WiMAX MS supporting a 10 MHz bandwidth. The procedure for other bandwidths is similar, however, some more R&S CMW settings may have to be adjusted.

1. Connect the N connector of your RF Diagnostic Chamber R&S DST200 to the bidirectional RF connector RF 1 COM of the R&S CMW, preferably using the high-quality RF cable supplied with the RF Diagnostic Chamber.
2. Place a fully functional and proven MS on the EUT table.
3. Switch on the R&S CMW and the MS.

4.3.2 Input Path Loss

Determining the input path loss requires the "WiMAX Measurements" and the "WiMAX Signaling" firmware applications.

1. Access the "WiMAX Signaling" firmware application and establish a connection between the R&S CMW and the MS, using default settings.

When the R&S CMW shows the connection status "Network Entry Completed", press the "MS Channel Report" softkey.

- Open the "Results > MS Channel Report" section in the measurement dialog and read the "UL TX Power (Data Carrier Power)" result.

MS Channel Report	
CINR Mean	28.000 dB
CINR Deviation	12.000 dB
UL TX Power (Data Carrier Power)	-37.000 dBm
RSSI Mean	-50.00 dBm
RSSI Deviation	-3.50 dB

Fig. 4-4: WiMAX Signaling: UL TX Power

- Open the "WiMAX Measurements" application and press ON | OFF to start the measurement.
- Open the "Multi Evaluation Configuration" dialog and enable an "Combined Signal Path" measurement scenario.

Scenario	Combined Signal Path
RF Routing	RF-Rx 1 Connector: RF1 COM
External Attenuation (Input)	0.00 dB
Frequency	3500.000000 MHz
Expected Nominal Power	0.00 dBm Ref.Level: 0.00 dBm
User Margin	0.00 dB

Fig. 4-5: WiMAX Measurement: RF Settings

- Close the configuration dialog and read the average "Subcarrier Power > Data" result from the "Measurement Overview" tables.

Subcarrier Power				
Data [dBm]	-69.65	-69.55	-69.76	-69.43
Pilots [dBm]	-69.55	-69.46	-69.56	-69.37

Fig. 4-6: WiMAX Measurements: Subcarrier Power

- To determine the input path loss of your mobile phone, subtract the measured "Subcarrier Power > Data" from the reported "UL TX Power (Data Carrier Power)" of the MS. In the example above, the input path loss equals to approx. $(-37.00 - (-69.65))$ dB = 32.65 dB.
- Re-open the "Multi Evaluation Configuration" dialog and enter the input path loss as an "External Attenuation (Input)"; see figure 4-5.



For the example above we assume that the "UL TX Power" reported by the MS corresponds to the power of one subcarrier. Adjust the calculation if your MS uses a different definition of the "UL TX Power".

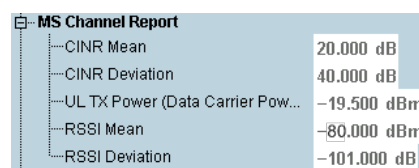
4.3.3 Output Path Loss

Determining the output path loss requires the "WiMAX Signaling" firmware application only.

1. Access the "WiMAX Signaling" firmware application and establish a connection between the R&S CMW and the MS, using default settings.

When the R&S CMW shows the connection status "Network Entry Completed", press the "MS Channel Report" softkey.

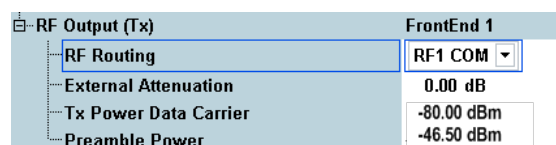
2. Open the "Results > MS Channel Report" section in the measurement dialog and read the "RSSI Mean" result.



MS Channel Report	
CINR Mean	20.000 dB
CINR Deviation	40.000 dB
UL TX Power (Data Carrier Pow...)	-19.500 dBm
RSSI Mean	-80.000 dBm
RSSI Deviation	-101.000 dB

Fig. 4-7: WiMAX Signaling: RSSI Mean

3. Expand the "General Settings > RF Output (Tx)" section and read the "Preamble Power".



RF Output (Tx)		FrontEnd 1
RF Routing		RF1 COM
External Attenuation		0.00 dB
Tx Power Data Carrier		-80.00 dBm
Preamble Power		-46.50 dBm

Fig. 4-8: WiMAX Signaling: Preamble Power

4. To determine the output path loss of your mobile phone, subtract the reported "RSSI Mean" from the "Preamble Power" of the downlink signal. In the example above, the output path loss equals to $(-46.5 - (-80.0))$ dB = 33.5 dB.
5. Enter the path loss as an "External Attenuation". The R&S CMW will increase its "TX Power Data Carrier" to ensure a correct input power at the MS receiver.



The RSSI scale covers DL powers between -123 dBm and -40 dBm. The 1-dB step width of the RSSI scale and the accuracy of the RSSI measurement at the MS limits the accuracy of the measured output path loss values. Ensure that the "Preamble Power" of your DL signal is within the RSSI range.

4.3.4 Other Network Standards

The measurement method outlined above is also suitable for determining path loss values for other network standards; [table 4-1](#) gives an overview of the necessary R&S CMW configuration and the essential settings.

As a general rule the R&S CMW must be equipped with a signaling application (option R&S CMW-KSxxx) plus a measurement application (option R&S CMW-KMxxx) for every

measured network standard. After the R&S CMW has established a connection with the EUT, the reported EUT output power is displayed in the measurement dialog of the signaling application. The R&S CMW input power must be determined using the measurement application. The input path loss is the difference between the two values:

Input path loss = EUT output power – R&S CMW input power

The R&S CMW generator power corresponds to the downlink/forward signal power that the R&S CMW uses for the connection; it is generally defined at the beginning of the configuration dialog of the signaling application, among other RF settings. The received signal level is reported by the EUT and appears in the measurement dialog of the signaling application. The output path loss is the difference between the two values:

Output path loss = R&S CMW generator power – Received signal level of EUT



Accuracy considerations

The EUT reports its output power and the received signal power as digital values (power steps). Each value denotes a power range, which necessarily limits the accuracy of the measurement method. The accuracies quoted below correspond to the distance between the reported power steps.

Differences for CDMA2000 and 1xEV-DO networks

In general CDMA2000 mobile stations (MS) and 1xEV-DO access terminals (AT) do not report their input and output power. The input path loss is most conveniently obtained in a measurement scenario where the MS/AT transmits at its known maximum power. The output path loss can be determined in an access probe measurement; see remarks 1 to 4 after the following table.

Table 4-1: Path loss measurements for different network standards using the R&S CMW

Standard	Required R&S CMW models	Required software options	Firmware version	EUT output power (UL)	R&S CMW input power (UL)	Resolution of input path loss / dB	R&S CMW generator power (DL)	Received signal level of EUT (DL)	Resolution of output path loss / dB
WIMAX	R&S CMW270 R&S CMW500	R&S CMW-KS700 R&S CMW-KM700	≥V1.0.10.1	UL TX Power (Data Carrier Power)	Subcarrier Power > Data Power	0.5	TX Power Data Carrier	RSSI Mean (– 40 dBm at max.)	1
GSM	R&S CMW280 R&S CMW500	R&S CMW-KS200 R&S CMW-KM200	≥V1.0.15.0	RF Settings > TCH/PDCH > Circuit Switched > PCL	Burst Power	1	RF Settings > TCH/PDCH > Reference Level	RX Level (– 48 dBm at max.)	1
WCDMA	R&S CMW280 R&S CMW500	R&S CMW-KS400 R&S CMW-KM400	≥V1.0.15.20	Transmitted UE Power	UE Power (RMS)	1	RF Settings > RF Power Downlink > Output Channel Power (for) / dBm + Physical Downlink Settings > P-CPICH Level / dB	CPICH RSPC (– 25 dBm at max.)	1
CDMA2000	R&S CMW500	R&S CMW-KS800 R&S CMW-KM800	≥V1.0.15.0	Max. Power (acc. to power class) ¹⁾	MS Power (1.23 MHz BW) ²⁾	–	CDMA power ³⁾	<Power offset> – (MS Power (1.23 MHz BW) – <Input path loss>) ⁴⁾	–
1xEV-DO	R&S CMW500	R&S CMW-KS880 R&S CMW-KM880	≥V1.0.15.0	Max. Power (acc. to power class) ¹⁾	AT Power (1.23 MHz BW) ²⁾	–	CDMA power ³⁾	<Power offset> – (AT Power (1.23 MHz BW) – <Input path loss>) ⁴⁾	–

- 1) See standard 3GPP2 C.S0011-A, "Maximum RF Output Power". Establish a connection and send TPC bits to command the MS/AT to transmit at maximum power. The maximum power depends on the power class of the MS.
- 2) The input power loss is the known maximum output power of the MS, depending on its power class, minus the measured MS power while the MS transmits at maximum power.
- 3) See standard 3GPP2 C.S0011-A, "Range of Open Loop Output Power". To obtain access probes with constant power, configure the signaling application as follows: "Network > Access Probes > Access Probes: Ignore, Probe Increment 0 dB".
- 4) When transmitting access probes, the MS/AT applies the open loop condition: the sum of the mean input power plus the mean output power is equal to a constant "Open Loop Power Offset". The mean output power of the MS/AT is the access probe power measured by the R&S CMW plus the input path loss determined previously. Open loop power offset values are specified in standard TIA-1030-C, depending on the band class and the spreading rate. Consequently the path loss measurement must be repeated for different band classes.

4.4 Determining Path Loss Values: R&S CMU200

External input and output attenuation factors are reported in the "RF IN/OUT" tab of the "Connection Control" dialog, which is provided for all network tests. The procedure for determining the path loss is analogous for all networks. The following examples show the necessary steps for a GSM mobile phone and a WCDMA UE.

4.4.1 Preparatives (GSM or WCDMA)

1. Connect the N connector of your RF Diagnostic Chamber R&S DST200 to the bidirectional RF connector RF 2 of the R&S CMU200, preferably using the high-quality RF cable supplied with the RF Diagnostic Chamber.
2. Place a fully functional and proven MS on the EUT table.
3. Switch on the R&S CMU200 and the MS.

4.4.2 GSM Path Loss

1. For a GSM MS, access the GSMxxx-MS function group (where xxx corresponds to the GSM band of your MS), "Signaling" test mode, to establish a call between the R&S CMU200 and the MS, setting the MS to a definite Power Control Level (PCL).

A PCL 15 for a GSM900 mobile phone corresponds to a nominal transmitter output power of 13 dBm. For more information refer to your operating manual for the GSMxxx-MS software options (R&S CMU-K20/-K21/-K22/-K23/-K24...), stock no. 1115.6088.12.

- Open the "Overview" dialog to display all measurement results that are relevant for determining the path loss values.

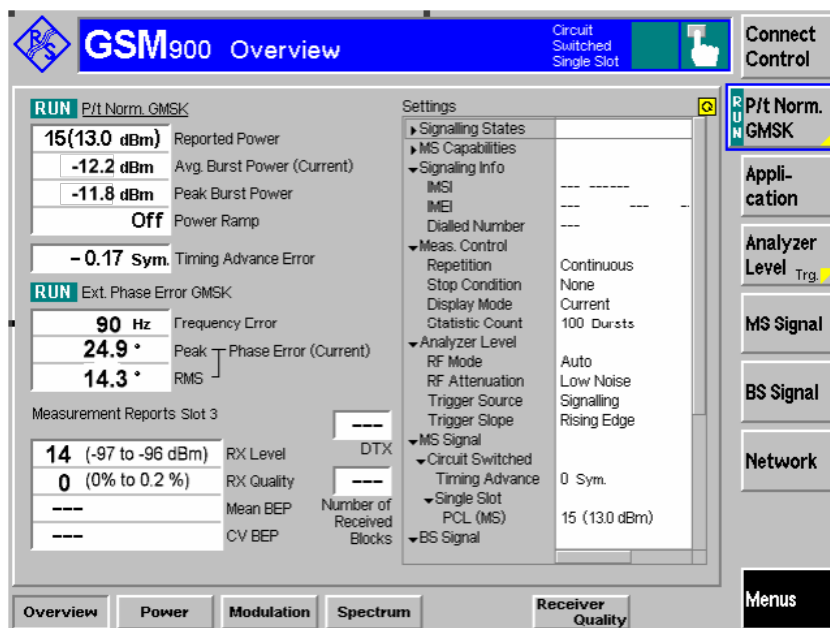


Fig. 4-9: GSM900 Signaling: Overview dialog

- To determine the output path loss of your mobile phone, subtract the reported "RX Level" at the MS from the output level of the R&S CMU ("BS Signal – TCH Level – Used TS"). In the example above, assuming a "Used TS" level of –70 dBm, the output path loss equals to $(-70.0 - (-96.5)) \text{ dB} = 26.5 \text{ dB}$.
- To determine the input path loss of your mobile phone, subtract the measured "Avg. Burst Power (Current)" from the "Reported Power" of the MS. In the example above, the input path loss equals to $(13.0 - (-12.2)) \text{ dB} = 25.2 \text{ dB}$.
- Press the "Connect. Control" softkey and the "RF IN/OUT" hotkey to report the path loss values to the R&S CMU200. Set the "Ext. Att. Output" equal to the output path loss and the "Ext. Att. Input" equal to the input path loss (see [GSM900 Signaling: RF IN/OUT tab](#)).

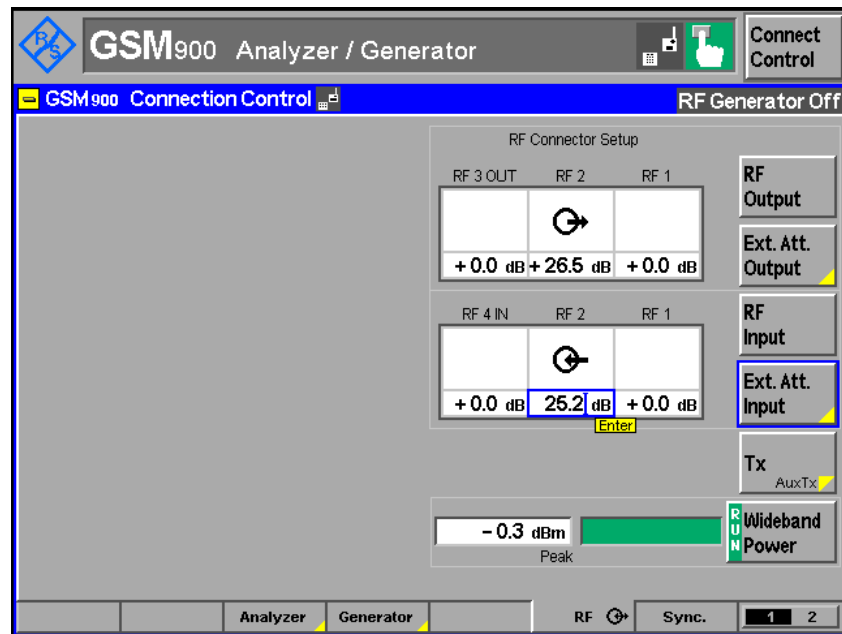


Fig. 4-10: GSM900 Signaling: RF IN/OUT tab

4.4.3 WCDMA Path Loss

1. For a WCDMA UE, access the "WCDMA UE" function group, "Signaling" test mode, to establish a call between the R&S CMU200 and the UE. Note the power class (1 to 4) of your UE, which is displayed in the "Connection" tab of the "Connection Control" dialog.
2. Open the "Receiver Quality" measurement dialog and select "Application – UE Report".

The UE reports various parameters characterizing the quality of the radio link, in particular the "CPICH RSCP" (Received Signal Code Power) of the current cell.

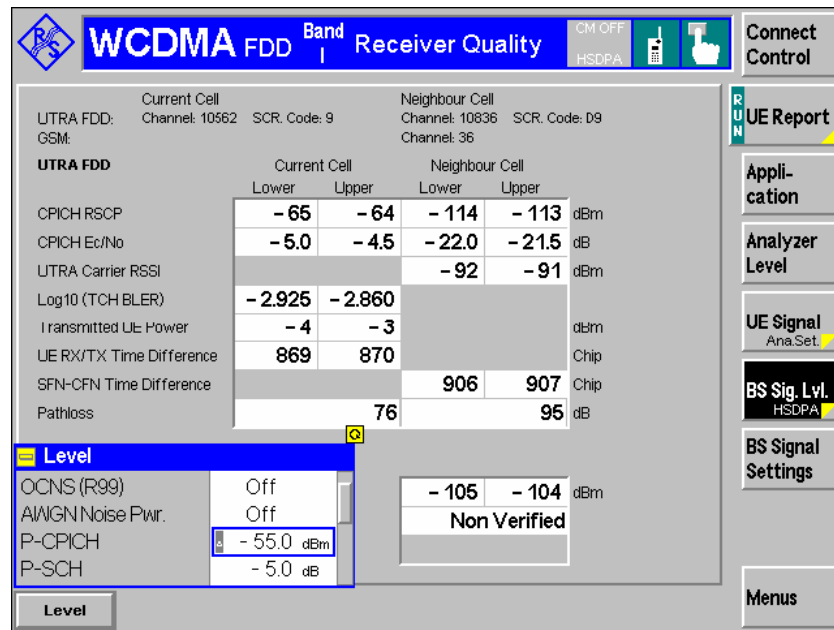


Fig. 4-11: WCDMA Signaling: UE Report dialog

- To determine the output path loss of your mobile phone, subtract the reported "CPICH RSCP" of the current cell from the P-CPICH output level of the R&S CMU ("BS Signal Lvl. – Level – P-CPICH"). In the example above, the output path loss equals to $(64.5 - 55.0) \text{ dB} = 9.5 \text{ dB}$.
- Open the "Power" measurement dialog and select "Application – Maximum Power" to command the UE to transmit at its maximum power.

The maximum UE transmitter output power depends on the UE power class; it is +33 dBm for power class 1, +27 dBm for power class 2, +24 dBm for power class 3, and +21 dBm for power class 4 UEs.

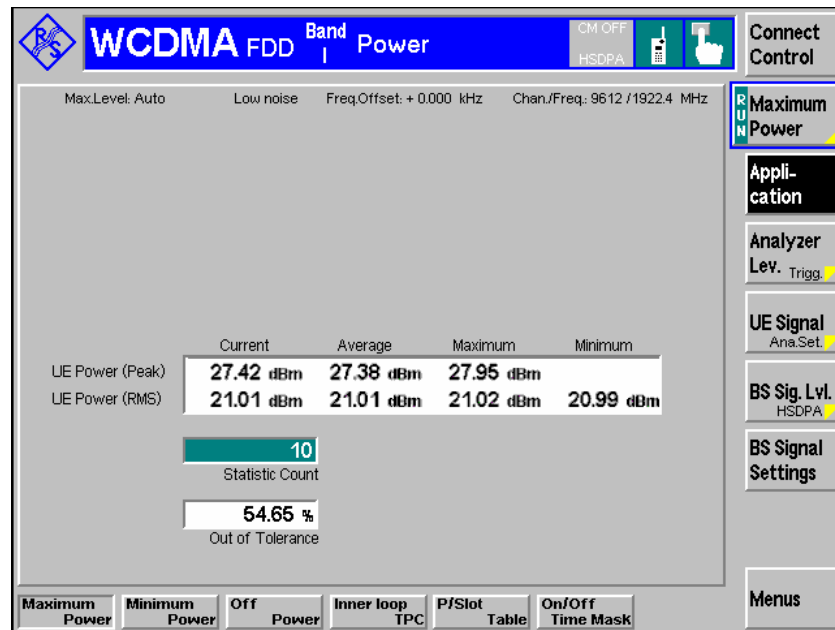


Fig. 4-12: WCDMA Signaling: Maximum Power dialog

- To determine the input path loss of your UE, subtract the measured "UE Power (RMS)" (preferably, the "Average" value) from the nominal maximum UE transmitter output power. In the example above, assuming a power class 3 UE, the input path loss equals to approx. $(24 - 21)$ dB = 3 dB.
- Press the "Connect. Control" softkey and the "AF/RF IN/OUT" hotkey to report the path loss values to the R&S CMU200. Set the "Ext. Att. Output" equal to the output path loss and the "Ext. Att. Input" equal to the input path loss.

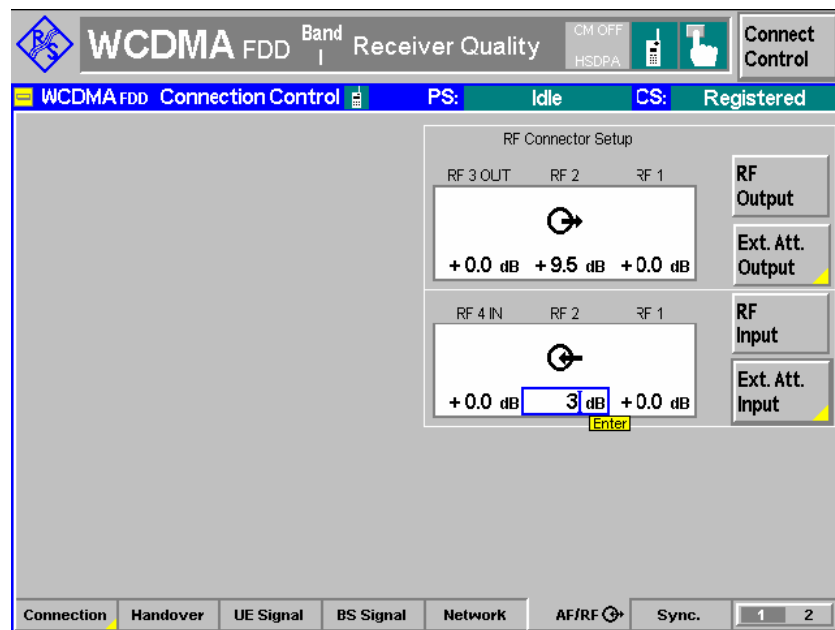


Fig. 4-13: WCDMA Signaling: AF/RF IN/OUT tab

5 Reference Path Loss Measurement

Over-the-air (OTA) measurements attempt to determine the performance of radio transmitters and receivers in a test environment which closely simulates the conditions in which the devices will be used. OTA tests for mobile phones have been promoted and specified by the Cellular Telecommunications & Internet Association (CTIA); refer to the "CTIA Certification, Test Plan for Mobile Station Over the Air Performance, Method of Measurement for Radiated RF Power and Receiver Performance, Rev. 3.0".

An important preparatory stage of any OTA measurement consists of removing the test system's influence from the radiated power and sensitivity results. To this end the equipment under test (EUT) is replaced by a reference antenna with known gain characteristics, and a reference path loss measurement is performed. The reference measurement is combined with the known gain of the reference antenna to determine an **isotropic** reference correction for the power and sensitivity results. The remainder of this section outlines how to perform the reference path loss measurement using the RF Diagnostic Chamber in combination with a vector network analyzer. For a detailed description of the measurement method refer to section "Range Reference Requirements" in the CTIA certification document.

The reference path loss measurement is different from the path loss measurement described in [chapter 4, "Path Loss Measurement"](#), on page 16 where the EUT (typically, a mobile phone) provides the information about the path loss values.

5.1 Background

The purpose of the reference path loss measurement is to relate the measured radiated power or sensitivity of the EUT to the same quantities from an ideal isotropic radiator. We define the total reference path loss PL of the RF Diagnostic Chamber as the difference:

$$PL = P_{RA} - P_{TA, ISO}$$

where P_{RA} is the input power and $P_{TA, ISO}$ is the output power, assuming that the chamber is equipped with an isotropic radiator. As shown in [figure 4-1](#) and in [figure 5-1](#), $P_{TA, ISO}$ depends on the propagation loss along the cable, the test antenna, and in free space.

Most conveniently, the RF input signal for the reference path loss measurement is fed to an additional RF feed through (the "Double N Connector" R&S DST-B102 mounted at one of the lower connector ports); the RF output signal is tapped at the standard upper "RF ANT" connector.



Disturbance due to cabling

Watch that the connecting cable does not disturb the radiation pattern of the isotropic radiator (or reference antenna, see below). The cable must be either outside the radiated field or perpendicular to the electric field **E**.

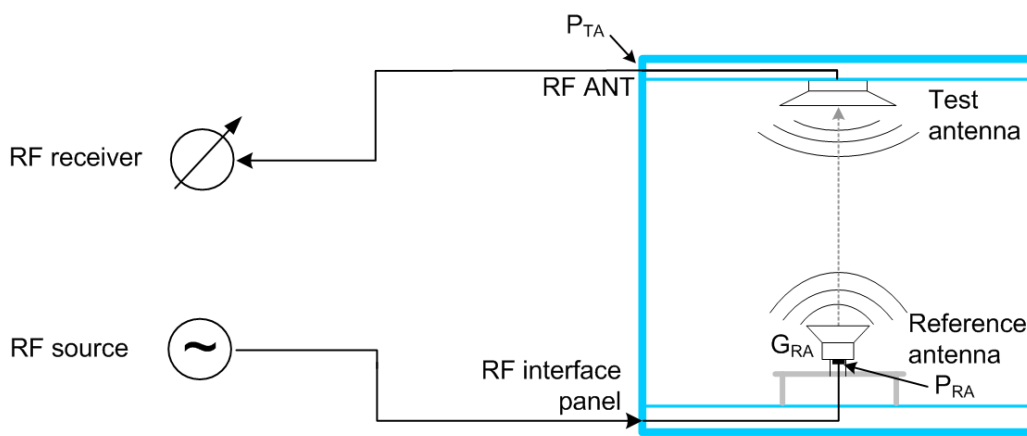


Fig. 5-1: Schematic test setup for reference path loss measurement

In practice, the ideal isotropic radiator is replaced by a calibrated reference antenna. The (known) gain of the reference antenna G_{RA} is defined as the difference between the antenna's actual radiated power and the ideal isotropic power, hence:

$$PL = G_{RA} + P_{RA} - P_{TA}$$

In the equation above, P_{TA} denotes the output power of the RF Diagnostic Chamber in the presence of the reference antenna, including the effect of the antenna's radiation characteristics. The power difference $P_{RA} - P_{TA}$ can be measured as described below. Together with the known value of G_{RA} this determines the total reference path loss PL.

5.2 Measurement

A vector network analyzer (VNA) is ideally suited for the reference path loss measurement because the necessary steps are all part of its basic functionality. The VNA will perform most of the necessary calculations by itself. To measure the power difference $P_{RA} - P_{TA}$,

1. Calibrate the connecting cables between the VNA source port and the input connector of the reference antenna and between the output connector ("RF ANT") of the chamber and the VNA receiver port.
2. Measure the connected RF Diagnostic Chamber in transmission.

Cable calibration

The suggested test setup uses port 1 of the VNA as a source port, port 2 as a receive port. Calibration is performed with all cables connected to both analyzer ports. For best accuracy, use high-quality RF cables and perform a full two-port calibration. Connect the required calibration standards successively to the cable ends as required by the selected calibration type.

The calibrated VNA results will relate to the cable ends. Calibration moves the "reference plane" from the VNA ports towards the input and output connectors of the chamber.

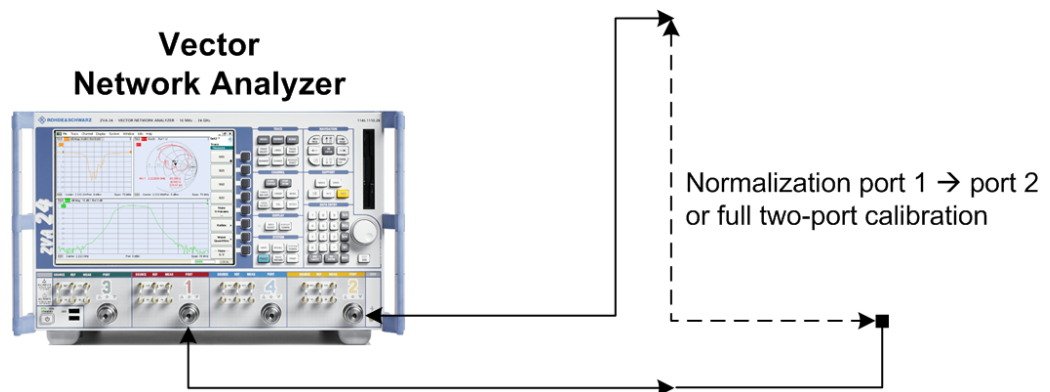


Fig. 5-2: VNA test setup for cable calibration

Transmission measurement

Apply the calibration and connect the cable ends to the input connector of the reference antenna and the RF ANT connector of the RF Diagnostic Chamber. Measure the forward transmission coefficient S_{21} , converted to a dB-magnitude value (this is the preset measurement mode of many VNAs). The power difference $P_{RA} - P_{TA}$ is equal to the negative of the transmission coefficient:

$$P_{RA} - P_{TA} = -|S_{21}|$$

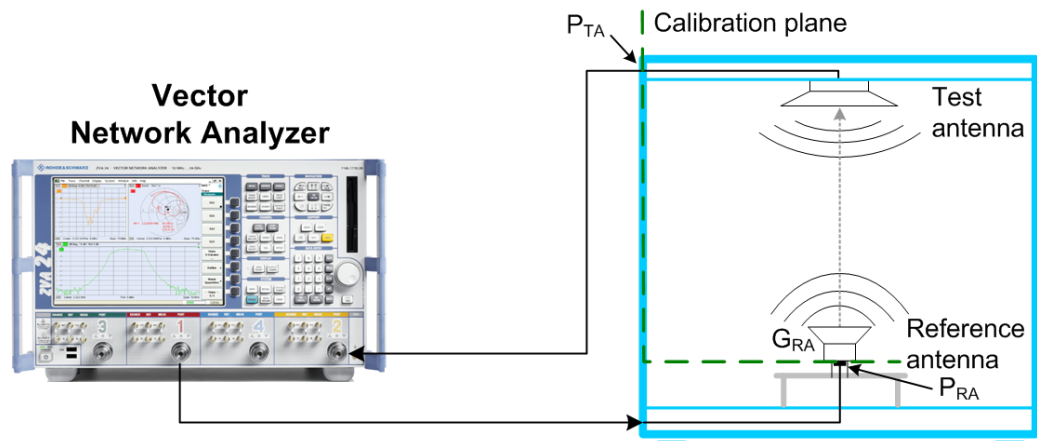


Fig. 5-3: VNA test setup for transmission measurement

Reference path loss calculation

To determine the reference path loss, add the antenna gain to the VNA results:

$$PL = G_{RA} - |S_{21}|$$

Reference path loss values must be acquired for all test frequencies, most easily by configuring an appropriate frequency sweep at the VNA. The path loss values must be stored and used to correct the OTA performance test results.

5.3 Generic RF Parameters

In [table 5-1](#) below, measured antenna factors AF, reference path loss values PL, and transducer factors TRD are listed in a frequency range between 700 MHz and 18 GHz. The measured values are valid for any linearly polarized electrical field in the horizontal plane ($E_z = 0$) incident on the test antenna (AF, PL) or the EUT (TRD, PL). The EUT is positioned at the origin of the rectangular coordinate system of the chamber, once on the top surface of the standard EUT table, once in the center of the 3D positioner (see [chapter 2.4, "3D Positioner"](#), on page 11).

The two distances $D_1 = 350$ mm and $D_2 = 280$ mm are the distances between the reference antenna / receiver and the test antenna.

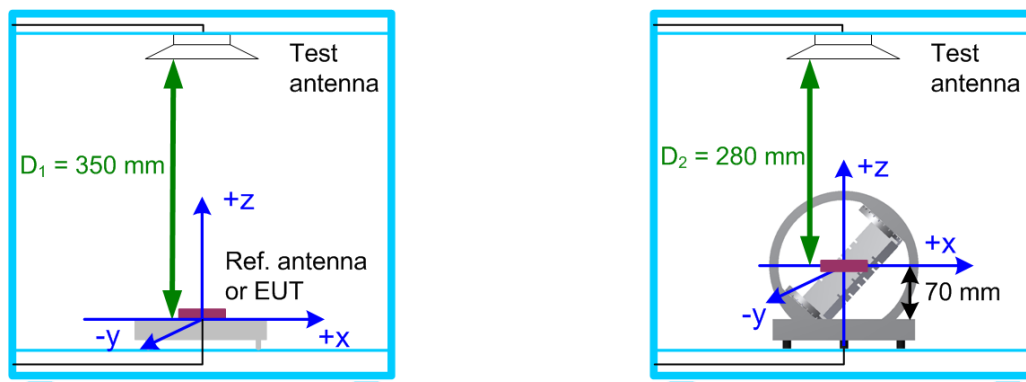


Fig. 5-4: Definition of distances between test antenna and reference antenna

The uncertainty U is the sum of the expanded uncertainty of the gain of the reference antenna utilized for determining the RF parameters, and the maximum uncertainty due to an imperfect axial ratio of the test antenna.

The test antenna factor AF ([dB/m], for EMI applications) is obtained as:

$$AF = E_{TA} - V_{TA}$$

where E_{TA} [dB μ V/m] is the electric field strength with horizontal polarization incident on the test antenna, and V_{TA} [dB μ V] is the output voltage at RF ANT. AF was determined using the standard EUT table (distance D_1).

The reference path loss PL ([dB], for OTA applications) is measured as described in [chapter 5.1, "Background"](#), on page 28:

$$PL = G_{RA} + P_{RA} - P_{TA}$$

The antenna transducer factor TRD ([dBV/m/sqrt(W)], for EMS applications) is given by:

$$TRD = E_{EUT} - 0.5 * P_{TA}$$

where E_{EUT} [dBV/m] is the electric field strength with horizontal polarization at the EUT location (D_1 or D_2) when the test antenna is fed with P_{TA} [dBW] into the RF ANT connector.



Using the table values

The values in [table 5-1](#) are generic values collected in a specific R&S DST200 sample measurement. To obtain the values specific for your RF Diagnostic Chamber, use a calibrated reference antenna and perform the reference path loss measurement as described in [chapter 5.2, "Measurement"](#), on page 29.

Table 5-1: RF parameters of a RF Diagnostic Chamber

Frequency [GHz]	AF at D ₁ [dB/m]	PL [dB]		TRD [dBV/m/sqrt(W)]		Uncertainty U [dB]
		D ₁	D ₂	D ₁	D ₂	
0.70	26.8	19.9	20.1	24.2	24.0	5.0
0.80	26.4	19.5	22.4	25.8	22.8	3.5
0.90	30.2	23.3	25.8	22.9	20.5	3.5
1.00	33.0	26.1	23.6	21.1	23.6	3.5
1.20	33.9	27.0	22.7	21.8	26.1	3.5
1.40	34.1	27.2	25.4	22.9	24.8	3.5
1.60	33.9	27.0	25.0	24.3	26.3	3.5
1.80	35.9	29.0	26.9	23.3	25.4	3.5
2.00	36.5	29.6	27.6	23.6	25.6	3.5
2.20	37.0	30.1	28.2	23.9	25.8	3.5
2.40	37.4	30.5	27.9	24.3	27.0	3.5
2.60	38.7	31.8	29.5	23.7	26.0	3.5
2.80	39.8	32.9	31.1	23.2	25.0	3.5
3.00	40.0	33.1	31.1	23.6	25.7	3.5
3.25	39.4	32.5	30.9	24.9	26.6	3.5
3.50	41.2	34.4	33.3	23.7	24.8	3.5
3.75	40.5	33.6	31.8	25.0	26.9	3.5
4.00	41.7	34.8	33.2	24.5	26.0	3.5
4.25	43.9	37.1	35.3	22.6	24.5	3.5
4.50	44.6	37.8	35.9	22.6	24.4	3.5
4.75	44.3	37.4	35.3	23.3	25.5	3.5
5.00	44.4	37.5	35.1	23.9	26.1	3.5
5.25	45.7	38.8	37.1	22.8	24.5	3.5
5.50	46.5	39.6	37.3	22.3	24.7	3.5
5.75	45.7	38.8	36.8	23.6	25.6	3.5
6.00	47.2	40.3	38.1	22.5	24.7	3.5
6.50	48.8	42.0	40.3	21.5	23.2	3.5

Frequency [GHz]	AF at D ₁ [dB/m]	PL [dB]		TRD [dBV/m/sqrt(W)]		Uncertainty U [dB]
		D ₁	D ₂	D ₁	D ₂	
7.00	48.4	41.5	39.6	22.6	24.5	3.5
7.50	50.0	43.1	41.7	21.5	23.0	3.5
8.00	51.9	45.0	43.0	20.3	22.3	3.5
8.50	49.3	42.4	39.6	23.4	26.2	3.5
9.00	50.9	44.0	41.8	22.3	24.5	3.5
9.50	51.6	44.8	42.8	21.8	24.0	3.5
10.00	51.8	44.9	43.3	22.2	23.9	3.5
10.50	52.6	45.8	43.5	21.7	24.2	3.5
11.00	53.1	46.3	44.2	21.7	23.9	3.5
11.50	54.2	47.4	45.0	21.0	23.5	3.5
12.00	54.4	47.5	45.6	21.3	23.2	3.5
12.50	55.9	49.0	45.8	20.1	23.3	3.5
13.00	55.6	48.7	46.7	20.5	22.7	3.5
13.50	56.7	49.8	47.1	19.7	22.7	3.5
14.00	58.5	51.7	49.0	18.6	21.1	3.5
14.50	57.2	50.4	49.0	19.7	21.5	3.5
15.00	55.0	48.1	46.9	22.4	23.9	4.0
15.50	57.9	51.1	48.3	20.1	22.7	4.0
16.00	59.3	52.4	48.8	18.8	22.5	4.0
16.50	56.8	50.0	48.3	21.5	23.2	4.0
17.00	56.8	50.0	47.8	21.9	24.0	4.0
17.50	55.9	49.0	47.5	23.0	24.6	4.0
18.00	56.2	49.4	46.5	23.2	25.9	4.0

A more complete set of RF parameters in a numeric ASCII format is available on the R&S DST200 product pages on the R&S internet.

6 Maintenance

The outside of the RF Diagnostic Chamber can be cleaned sufficiently using a soft, lint-free dust cloth.

Shielding gaskets at the front door

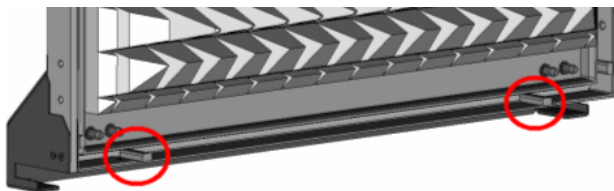
The front door and the EMI/EMC shielding gaskets around the door joint must be inspected at regular intervals. The purpose of the gaskets is to ensure a good, continuous electrical contact between the closed door and the front side of the chamber. To maintain the shielding effectiveness of the chamber, the gaskets must be regularly cleaned.

To clean the gaskets, gently wipe the contact surfaces with a clean cloth soaked in ethyl alcohol. If corrosion or discoloration persists, you can clean the surfaces using a non-scratch scrub sponge such as Scotch-Brite™. There is no need to coat the cleaned gaskets with lubricant or oil.

If corrosion still persists, replace the gaskets as described in [chapter 7.4, "Replacing the Shielding Gaskets"](#), on page 37. Replace all gaskets with broken, bent, or missing fingers.

Distance rails at the front door

Open the door and clean the distance rails at the bottom side with alcohol or a similar cleaning solution. Apply the grease with a small brush, and note that only a small amount of grease is necessary. If the rim of the front door is dirty, clean it with alcohol before closing the door. Repeat the maintenance every six months.



Inspection intervals

The door and the shielding gaskets should be inspected every six months. Shorter inspection and cleaning intervals are recommended if the RF Diagnostic Chamber is used very frequently or if it is exposed to temperature change, humidity, or corrosive environments.

7 Installation, Repair, Functional Check

The subjects in this chapter are not relevant for normal use of the RF Diagnostic Chamber. Read the information if you wish to mount optional accessories, replace expendable parts, or check the operability and the rated specifications.

7.1 Accessing the Upper Compartment

The upper compartment accommodate the connecting RF cable between the RF ANT connector at the top of the right-hand wall and the test antenna. An additional connector module can be mounted at the second upper connector port. Moreover, it is allowed to place additional circuitry (e.g. an amplifier) into the upper compartment. The antenna and the antenna cable are available as expendable parts (see [table 7-1](#)), however, there is no need to access or remove the test antenna for normal use of the RF Diagnostic Chamber.

NOTICE

Shielding effectiveness

Always use optimally shielded RF cables inside the upper compartment. Semi-rigid cables are recommended.

It is possible to use the RF Diagnostic Chamber with an open cover plate. The shielding effectiveness specified in the data sheet applies to a closed upper compartment.

To access the upper compartment, remove all screws at the top side and lift the cover; see [figure 2-1](#).

7.2 Accessing the Lower Compartment

The lower compartment accommodate the connecting cables between the additional connector modules and the EUT, including possible converters. The cables may be passed through a hole in the chamber's base plate.

To remove the base plate and access the lower compartment,

1. Open the front door completely (see also [chapter 2.2, "Opening and Closing the Front Door"](#), on page 8).
2. Lift the EUT table until you can remove it from the chamber.
3. Remove the four pieces of radiation absorbent material (RAM) which cover the base plate.
4. Remove the 2 screws on either side of the base plate.

5. Lift the front edge of the base plate using the borehole in center until you can pull it out without damaging the EMI/EMC shielding gaskets around the joint of the door.

If necessary, you can also remove the collateral RAM panels.

Proceed in reverse order to close the lower compartment and make the chamber ready for use.

NOTICE**Position of the EUT table**

The four poles of the EUT table establish a firm connection to the base plate. To ensure that the table remains at a stable position relative to the chamber and the test antenna, always affix the base plate using the two screws.

The EUT table and all absorbers (RAM panels) are available as expendable parts; see [table 7-1](#).

7.3 Mounting Filter and Interface Panels

The RF Diagnostic Chamber R&S DST200 is delivered with integrated test antenna. The N-connector unit labeled RF ANT ensures the RF connection between the antenna and the external test equipment; it always occupies the connector port at the top of the right-hand wall, towards the front door of the chamber (see [figure 2-1](#)). Additional filter and interface panels (options R&S DST-B101, R&S DST-B102, R&S DST-B103) can be mounted at any of the four remaining module ports at the top and bottom of the right-hand wall. Select the position of the panels according to your needs.

The connector units are delivered with spare EMI/EMC shielding gaskets. When mounting a unit, ensure that the contact surfaces at the unit and the RF Diagnostic Chamber are clean and the gaskets are in correct position, with the teeth to the outside of the chamber opening (see [chapter 7.4, "Replacing the Shielding Gaskets"](#), on page 37). Apply the connector module to the module port and affix it using the 18 screws delivered with the module. Fix the screws progressively in cycles in order to achieve uniform contact.

To remove a connector module, simply unscrew the 18 screws. Use a blank plate to cover every unused module port.

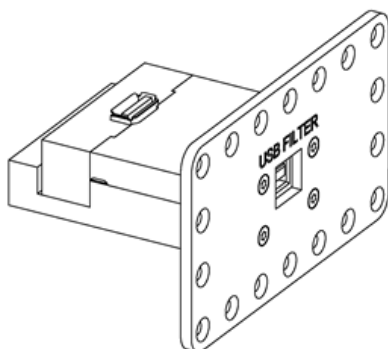


Fig. 7-1: Example of a connector unit (DST200 Filter Panel, USB)

To connect the additional feed throughs to the antenna or to the EUT, you will usually have to access the upper and/or lower compartments of the RF Diagnostic Chamber. Proceed as described in [chapter 7.1, "Accessing the Upper Compartment"](#), on page 35 and [chapter 7.2, "Accessing the Lower Compartment"](#), on page 35.

7.4 Replacing the Shielding Gaskets

The EMI/EMC shielding gaskets in the U-shaped joint around the front side of the chamber and the contact strips of the connector units and antenna are expendable parts which must be replaced if they are visibly corroded or damaged. It is recommended to use a plastic screwdriver for this purpose to avoid scratching the groove and the walls of the RF Diagnostic Chamber.

Replacing the gaskets at the front side

The U-shaped joint at the front side contains a knitted-wire copper shielding cord which is covered by a band of clip-on gaskets. To replace the gaskets,

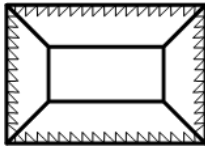
1. Carefully lift the clip-on gaskets from the groove starting at the corners.
2. Remove the shielding cord, starting at the point where the ends are joined.
3. Clean the empty groove using a soft cloth soaked in ethyl alcohol (see also [chapter 6, "Maintenance"](#), on page 34).
4. Cut the new cord and clip-on gaskets to cover the whole length of the groove.
5. Exercise care when placing the new cord and clip-on gaskets in position, as a squeezed cord or bent fingers will deteriorate the shielding effectiveness.

Replacing the contact strips

The connector units and the antenna are shielded by four self-adhesive metal contact strips. After removing the connector unit,

1. Remove the old gaskets using a plastic screwdriver.

2. Clean the contact surface below the gaskets using a soft cloth soaked in ethyl alcohol (see also [chapter 6, "Maintenance"](#), on page 34).
3. Place the new gaskets in position, with the teeth towards the outer boundary as shown below.



New EMI/EMC gaskets are available as expendable parts; see [table 7-1](#). See also [chapter 6, "Maintenance"](#), on page 34.

7.5 Functional Check

The technical data of the RF Diagnostic Chamber R&S DST200 and the test antenna are listed in the data sheet. To check compliance with the rated VSWR specifications of the antenna, you can use one of the following measurement devices:

- Network analyzer with a frequency range up to 6 GHz **or**
 - Spectrum analyzer with tracking generator up to 6 GHz and reflection measurement bridge
1. For network analyzers: Connect the RF cable supplied with the chamber to the network analyzer and calibrate the analyzer for a reflection measurement.
 2. Connect the analyzer (or the bridge) to the **closed** chamber using the RF ANT bidirectional N connector and the RF cable.
 3. Measure the reflection (i.e. the dB-magnitude of the forward reflection coefficient S_{11}) at different frequencies

The reflection must be below the value specified in the data sheet across the entire frequency range of the test antenna.

The RF shielding complies with the rated specifications provided that the cover plate is mounted, the front door is completely closed, and the EMI/EMC shielding gaskets are in place and not corroded or damaged; see [chapter 7.4, "Replacing the Shielding Gaskets"](#), on page 37.

7.6 Expendable Parts

The mechanical expendable parts for the RF Diagnostic Chamber are listed below. Please contact your local Rohde & Schwarz service center if you need to order spare parts:

http://www2.rohde-schwarz.com/en/service_and_support/service_locations/

Table 7-1: List of expendable parts

Part designation	Stock no.	Remarks
FEEDTHROUGH PANEL BLIND	1514.2101.00	See chapter 7.3, "Mounting Filter and Interface Panels" , on page 36
EUT TABLE	1514.7655.00	See chapter 7.2, "Accessing the Lower Compartment" , on page 35
VELCRO FASTENER HOOK ADHESIVE VELCRO FASTENER LOOP ADHESIVE	1515.1344.00 ¹⁾ 1515.1350.00 ¹⁾	See chapter 1, "Safety Instructions" , on page 5
ABSORBER BOTTOM ABSORBER TOP ABSORBER WALL	1514.5517.00 ²⁾ 1514.5523.00 1514.5500.00 ²⁾	See chapter 7.2, "Accessing the Lower Compartment" , on page 35
SPIRAL ANTENNA TS-ANTC6	1514.7855.02	See chapter 7.1, "Accessing the Upper Compartment" , on page 35
EMV GASKET SPRING EMV GASKET 7.9 MM EMV GASKET FLAT	1515.1380.00 ¹⁾ 1515.1367.00 ¹⁾ 1515.1373.00 ¹⁾	For front panel For front panel For connector units and antenna See chapter 7.4, "Replacing the Shielding Gaskets" , on page 37
FEEDTHROUGH UNIT N SINGLE	1514.5481.00	See chapter 7.3, "Mounting Filter and Interface Panels" , on page 36
ANTENNA CABLE SMA-N	1514.5623.00	See chapter 7.1, "Accessing the Upper Compartment" , on page 35
RETAINING WASHER	0031.5085.00	—

1) Contains necessary quantity for the whole unit.

2) 4 pieces necessary for the whole unit.

Glossary

A

AF: Audio frequency **or** antenna factor

C

CTIA: Cellular Telecommunications & Internet Association

CWG: Converged Wireless Group

D

DC: Direct current

E

EMI: Electromagnetic Interference

EMS: Electromagnetic Susceptibility

EUT: Equipment under test

M

MS: Mobile phone, mobile station

O

OTA: Over-the-air (tests)

P

PL: Path loss

PTCRB: PCS Type Certification Review Board

R

RAM: Radio absorbent material

RF: Radio frequency

T

TA: Test antenna

TRD: Transducer factor

V

VNA: Vector network analyzer

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